Case Report: Chronic Ankle Instability in a 14-year-old, African American, Basketball Player

By

Sneha Paswan, SPT

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Department of Physical Therapy
Angelo State University
Member, Texas Tech University System
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Abstract

Background and Purpose:

Reoccurring lateral ankle sprains in this individual have contributed to chronic ankle instability. The purpose of this case study is to outline the evaluation and treatment approach that was used for the rehabilitation of this patient as well as compare it to current evidence-based practice guidelines.

Case Description:

The patient is a 14-year-old, African American basketball player that has an extensive history of lateral ankle sprain that have contributed to chronic ankle instability. This patient presents 1 month following acute LAS that hasn't healed as usual. Primary concerns with this patient are lateral ankle pain, decreased range of motion and strength, and decreased balance and postural control.

Outcomes:

This patient successfully completed rehabilitation for his acute injury and chronic instability concerns. He was able to return to sport with external bracing and demonstrated improved balance and joint stability by end of care.

Discussion:

This case study offers a model for successful rehabilitation for a young, active patient. Further investigation should be conducted to examine optimal treatment guidelines for a variety of patient populations.

Key Words: Ankle, instability, athlete, chronic, rehabilitation

Introduction

Ankle sprain occurrence in athletic populations is exceedingly common, making up 45% of all sports related injuries; individuals at increased risk are those who participate in fast, lateral cutting motions for sport (Fu et al. 2014). According to a sixteen-year, longitudinal study of athletic injuries across NCAA sports by Hootman (2007), this increased risk is particularly associated with athletes participating in volleyball, football, and basketball. A common mechanism of injury for ankle sprains is a rapid shift of body weight over a foot in weight bearing that causes the ankle to roll with resultant ligamentous stretching and tearing. The most frequently occurring instance of this injury is the lateral ankle sprain (LAS), with a sudden ankle plantar flexion and inversion force damaging 3 lateral ankle ligaments: most frequently, the anterior talo-fibular ligament, as well as the posterior talo-fibular ligament, and calcaneo-fibular ligament (Sueki & Brechter, 2010). This single insult of diminished lateral joint integrity presents the additional concern of recurrence, with 73% of individuals acutely diagnosed with ankle sprains likely to experience reoccurring injuries and ankle instability (Hung and Miller, 2016). With these repetitive cases, acute trauma progresses to a condition known as chronic ankle instability (CAI) without appropriate care. These individuals present with deficient proprioception, postural control, motor recruitment, strength, gait biomechanics, range of motion, and balance compared to healthy individuals (Moisan et al, 2020). These impairments cumulatively promote a feeling of instability or apprehension during activity, which adds a significantly increased risk of recurrent ankle injury, thus creating a cycle of instability and insult (Karlsson et al, 1996).

This case study provides a model of successful rehabilitation of an acute lateral sprain associated with chronic ankle instability. Though general guidelines exist on rehabilitation

considerations for ankle instability, this study provides specific rehabilitation techniques that were successful for a young, motivated, athletic individual.

Case Description – See "Tables and Figures" for patient demographics

The patient in this case is a 14-year-old, African American, male, high school basketball player. The patient has a long history of ankle sprains going back as far as he can remember. He reports 3-4 ankle sprains in the past 6 months with his most recent injury resulting in PT intervention; he denies seeking out medical help for any previous injuries. Outside of minor injuries associated with sport, the patient appears to be in good health. Patient denies any other health concerns or comorbidities. The patient is currently limited from participation due to recent ankle injury. He reports a sudden onset of ankle pain associated with an injury occurring 1 month before reporting to PT. The MOI was an exaggerated cutting motion during basketball that resulted in the ankle "giving out". He notes that he sat out from sport for about a week as he usually would with this type of injury but noticed that he hadn't improved as usual by that point, so he sought out medical help. The patient's chief complaints are pain in the lateral ankle and concern about reoccurring injury affecting his ability to participate in sport. He reports fluctuating inflammation of the lateral ankle, feelings of instability. The patient reports the greatest incidence of pain – reported as a 6/10 on the numeric pain rating scale – with walking, WB, and during sport. He reports he is without pain while resting, icing, and elevating leg and after taking ibuprofen. He notes average pain rating is a 4/10. The patient's primary goal is to be able to manage his reoccurring injuries so that he can continue his basketball career and play in college.

Examination – See "Tables and Figures" for detailed examination findings

The patient presents in clinic with mild antalgic gait without assistive device; he demonstrates decreased WB over injured right leg, decreased toe off, and increased stance phase over uninvolved leg. The patient reports moderate pain and difficulty with ADLs, sport, and standing/walking over level surfaces. Patient's postural assessment includes bilateral pes planus, knee valgus, posterior rotated pelvis with decreased lumbar lordosis, as well as FHRS. Patient's sensation screening is unremarkable; pt. is moderately TTP over ATFL with increased scar tissue palpable. The patient was given an LEFS questionnaire to assess his subjective interpretation of function (Binkley et al. 1999). A CAIT questionnaire was administered to determine the patient's interpretation of ankle stability because due to notable instances of instability and several previous injuries (Hiller et al. 2006).

Examination of the patient's strength and mobility indicates significantly decreased strength of the affected right ankle that was limited by pain. The patient also presents with slightly decreased strength and control of bilateral hip musculature. He presents with overall limited right ankle ROM; plantar flexion is notably hypermobile compared to uninvolved side as well as normative range. Though the patient had no confirmatory imaging done, he presented with a clear MOI for a LAS. Anterior drawer and talar tilt special tests (See Appendix for reference photos) performed to confirm suspected diagnosis and assess severity of injury; findings of positive anterior drawer and negative talar tilt confirm a grade 2 LAS (Seuki & Brechter 2010). A single leg balance test was performed to assess performance and stability. This indicated severely limited balance and postural control with single leg WB and gives a reliable benchmark for progress to be measured from (Troijan & McKeag 2006).

This patient's examination was in accordance with current clinical practice rules for LAS as outlined in the JOSPT. Findings of this examination confirm the PT diagnosis of an acute, but resolving, LAS. This patient also fits current CPR for CAI designation as identified by a CAIT score less than 23 as well as indication of functional deficits with performance measures (Martin 2021). As the patient's acute injury has largely resolved independently by the time of initial evaluation, his prognosis and rehab potential are overall excellent. The patient should be clear to return to sport within 2-3 weeks after improvements have been made in pain/inflammation reduction, ROM, and muscle strength. Patient will benefit from skilled therapy for a total of about 6-8 weeks to address gait mechanics, dynamic instability, proprioception deficits, and increase neuromuscular control to reduce risk of further injury (D'Hooghe et al. 2020).

Intervention – See "Tables and Figures" for detailed therapeutic interventions

Upon initiation of treatment, the patient was educated about his pathology. The patient was educated about healing timeline for LAS; he presented as though between the protective phase and progressive/sensorimotor phase of healing, so initial goal of treatment would be pain and inflammation management and would progress to increase load tolerance with activity. The patient was also educated about the importance of addressing CAI. This patient had endured numerous insults to the ligamentous support structure of his ankle and presented with significant deficits in balance and stability. He also had a desire to participate in high-level basketball, which put him at further risk of injury. The patient demonstrated a desire to address the cause of the issue with skilled PT. The patient was also educated to use an external, lace-up ankle brace when he was able to return to sport to provide extrinsic stability while the intrinsic components were addressed. In addition, he was prescribed an arch support orthotic to facilitate safer joint alignment (Martin et al. 2021).

Manual therapy interventions were applied regularly during this patient's initial plan of care (POC). Retrograde massage was utilized to facilitate reduction of inflammation. Pressure was applied for about 1-2 minutes in a stroking, distal to proximal fashion to the popliteal fossa to facilitate reabsorption of edema. Cross friction massage was applied for about 1-2 minutes, as per patient tolerance, to the ATFL in or to promote reduction of scar tissue. The patient was moderately TTP and had notably palpable scarring. Grade 1-2 anterior-to-posterior talocrural joint mobilizations initially applied to reduce pain for about 1-2 minutes. As PT continued, patient tolerance to manual therapy increased, and self-reported pain continued to subside, joint mobilizations progressed to grade 3-4 to increase dorsiflexion ROM. Mobilizations were further

progressed to mobilization with movement to continue progress dorsiflexion ROM and facilitate appropriate joint kinematics in motion (See Appendix for reference photos for mobilizations). Soft tissue mobilization applied for about 1-2 minutes to the gastroc/soleus complex and peroneal muscles to reduce muscle tension associated with guarding. PROM applied as a manual intervention initially to supplement limited AROM; this intervention was discontinued as the patient's pain-free AROM increased. All manual interventions were administered as recommended by Martin's clinical practice guidelines for LAS and CAI (2021).

Therapeutic exercise primarily focused on increasing strength distally at the foot and proximally at the hip. Though his patient was strong, particular focus was made on strengthening the patients hip musculature, particularly hip abductors and extensors, in order to provide proximal control and promote greater hip strategy balance control (McCann et al. 2018). Exercises were also prescribed to address foot intrinsic muscles to support longitudinal arch. In addition to recommended orthotics, these interventions aimed to increase foundational support, increase proprioception, and facilitate greater motor adjustment to maintain stability with activity (Fraser et al. 2016). In the early POC, isometric exercises were utilized to reduce pain and promote recruitment of motor units. Per patient tolerance, exercises were progressed to concentrically utilize muscles throughout a full ROM, then to eccentric exercises to enhance progressive loading, and finally plyometric exercises to simulate demands of sport. The goal of strengthening was initially force production, then endurance, then output of power (Martin 2021).

Therapeutic activities primarily focused on proprioception and balance control and later incorporated sport specific activity. Exercises initially involved stabilization and balance on level

surfaces. Per patient tolerance, exercises were progressed to stress the sensorimotor system that is negatively impacted by CAI. This involved a variation of surface texture to challenge proprioception, reduction/manipulation of visual inputs to further stress the utilization of sensory inputs for balance control, and cognitive loading with activity to enhance dual tasking. Exercises were made progressively more dynamic to simulate the patient's sport. Focus was made to correct right sided in-toeing and decreased foot clearance that was notable with higher level activities to reduce positional plantarflexion and inversion moment that was associated with increased risk of LAS (Bonnell et al. 2010). Facilitation of hip abductors, and ankle dorsiflexors and evertors though a variety of cueing was utilized to correct lower extremity posture in swing phase of gait.

Outcomes – See "Tables and Figures" for detailed outcome assessment

At the time of initial evaluation, the patient's acute ankle injury had largely self-resolved. His primary goals were to continue to increase load tolerance and address longstanding instability issues. Pt. demonstrated excellent tolerance to therapeutic intervention and demonstrated compliance with HEP. At six weeks out from initial injury, he was released to return to gradual reintegration to sport on the condition that he wore an external lace-up brace. Pt. was noncompliant with this condition and experienced an exacerbation of symptoms; as a result, therapeutic interventions were regressed for 2 appointments until there was no reported pain, swelling, or lingering complications. The patient continued to make consistent progress in overall strength, ROM, dynamic control, and postural stability following this setback. Discharge evaluation was scheduled for this patient; however, he contracted COVID-19 prior to scheduled appointment and requested to be discharged without evaluation. He had met all goals, returned to sport by this point without concern, and was compliant with continued HEP and external bracing. The patient was discharged and educated to continue independent rehabilitation.

Discussion

This patient demonstrated successful rehabilitation following current clinical practice guidelines for LAS and CAI (Martine et al. 2021). This patient was a high-level athlete that demanded a higher level of rehabilitation goals and benefited from higher progressions of activity. He presented a challenge in limiting himself from activity to allow healing time. He also was intermittently complaint with external bracing and required significant education to encourage consistent use. Limitations in this case were a lack of higher-level performance measures due to constraints in clinic space and equipment.

Despite limitations, this case study does represent a model of therapeutic interventions for a high-level athlete looking to return to sport following rehabilitation of LAS and CAI. Though this rehabilitation approach may not directly apply to all populations afflicted with this pathology, it does outline successful progression of weightbearing, reclamation of strength and mobility, as well as improvement in overall stability and dynamic control to reduce risk of reoccurring injury. Further research could provide greater indication of successful rehabilitation in a variety of patient populations.

References

Fu W, Fang Y, Liu Y, Hou J. The effect of high-top and low-top shoes on ankle inversion kinematics and muscle activation in landing on a tilted surface. *J Foot Ankle Res*. 2014;7(1):14. Published 2014 Feb 18. doi:10.1186/1757-1146-7-14

Hootman JM, Dick R, Agel J. Epidemiology of collegiate injuries for 15 sports: summary and recommendations for injury prevention initiatives. *J Athl Train*. 2007;42(2):311-319.

Seuki, D., & Brechter, J. (2010). Ankle Sprains. In K. Falk (Ed.), Orthopedic Rehabilitation Clinical Advisor (pp. 624-625). L. Duncan.

Hung YJ, Miller J. Extrinsic visual feedback and additional cognitive/physical demands affect single-limb balance control in individuals with ankle instability. *World J Orthop*. 2016;7(12):801-807. Published 2016 Dec 18. doi:10.5312/wjo.v7.i12.801

Moisan G, Mainville C, Descarreaux M, Cantin V. Kinematic, kinetic and electromyographic differences between young adults with and without chronic ankle instability during walking. *J Electromyogr Kinesiol*. 2020;51:102399. doi:10.1016/j.jelekin.2020.102399

Karlsson J, Eriksson BI, Swärd L. Early functional treatment for acute ligament injuries of the ankle joint. *Scand J Med Sci Sports*. 1996;6(6):341-345. doi:10.1111/j.1600-0838.1996.tb00104.x

Binkley JM, Stratford PW, Lott SA, Riddle DL. The Lower Extremity Functional Scale (LEFS): scale development, measurement properties, and clinical application. North American Orthopaedic Rehabilitation Research Network. Phys Ther. 1999;79(4):371-383.

Hiller CE, Refshauge KM, Bundy AC, Herbert RD, Kilbreath SL. The Cumberland ankle instability tool: a report of validity and reliability testing. Arch Phys Med Rehabil. 2006;87(9):1235-1241. doi:10.1016/j.apmr.2006.05.022

Trojian TH, McKeag DB. Single leg balance test to identify risk of ankle sprains. *Br J Sports Med*. 2006;40(7):610-613. doi:10.1136/bjsm.2005.024356

Martin, R., Davenport, T., Fraser, J., Sawdon-Bea, J., Carcia, C., Carroll, L., Kivlan, B. and Carreira, D., 2021. Ankle Stability and Movement Coordination Impairments: Lateral Ankle Ligament Sprains Revision 2021. *Journal of Orthopaedic & Sports Physical Therapy*, 51(4), pp.CPG1-CPG80.

D'Hooghe P, Cruz F, Alkhelaifi K. Return to Play After a Lateral Ligament Ankle Sprain. *Curr Rev Musculoskelet Med*. 2020;13(3):281-288. doi:10.1007/s12178-020-09631-1

McCann RS, Bolding BA, Terada M, Kosik KB, Crossett ID, Gribble PA. Isometric Hip Strength and Dynamic Stability of Individuals With Chronic Ankle Instability. *J Athl Train*. 2018;53(7):672-678. doi:10.4085/1062-6050-238-17

Fraser JJ, Feger MA, Hertel J. MIDFOOT AND FOREFOOT INVOLVEMENT IN LATERAL ANKLE SPRAINS AND CHRONIC ANKLE INSTABILITY. PART 1: ANATOMY AND BIOMECHANICS. *Int J Sports Phys Ther*. 2016;11(6):992-1005.

Bonnel F, Toullec E, Mabit C, Tourné Y; Sofcot. Chronic ankle instability: biomechanics and pathomechanics of ligaments injury and associated lesions. *Orthop Traumatol Surg Res*. 2010;96(4):424-432. doi:10.1016/j.otsr.2010.04.003

Tables and Figures

Patient Demographics	
Height	5'11"
Weight	170 lbs
BMI	23.7
Race	African American
Sex/Gender	Male/male
Age	14

Patient Intake Questionnaires	
LEFS	Total = 62/80; % max function = 77.5%
CAIT Questionnaire	Total = 14/30 → indicative of CAI

Active Range of Motion (AROM)			
LEFT		RIGHT	
Joint	ROM	Direction (norms)	Current/Goal
Ankle	WNL	Ankle: • DF (15-25) • PF (45-55) • INV (30-40) • EV (15-25)	 • 6/25 degrees • 60/60 degrees → pain • 35/40 degrees → pain • 10/25 degrees
Knee	WNL	Knee	WNL
Hip	WNL	Hip	WNL

Manual Muscle Tests					
LEFT			RIGHT		
Joint	Current	Goal	Joint	Current	Goal
Ankle			Ankle		
• DF	• 5/5		• DF	• 3-/5	• 5/5
• PF	• 5/5		• PF	• 3-/5	• 5/5
• INV	• 5/5		• INV	• 3+/5	• 5/5
• EV	• 5/5		• EV	• 3+/5	• 5/5
Knee			Knee		
• FLEX	• 5/5		• FLEX	• 5/5	
• EXT	• 5/5		• EXT	• 5/5	
Hip			Hip		
• FLEX	• 5/5	• 5/5	• FLEX	• 4+/5	• 5/5
• EXT	• 4-/5	• 5/5	• EXT	• 4-/5	• 5/5
• ADD	• 5/5	• 5/5	• ADD	• 4+/5	• 5/5
• ABD	• 4-/5	• 5/5	• ABD	• 4/5	• 5/5
• IR	• 4/5	• 5/5	• IR	• 4/5	• 5/5
• ER	• 4/5	• 5/5	• ER	• 4/5	• 5/5

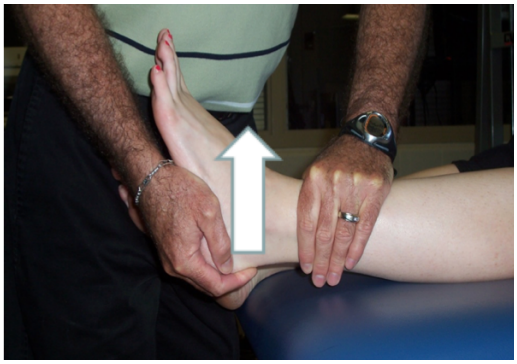
Tests and Measures		
Measurement	Result	Goal
Special Tests		
• Anterior Drawer Test	• Positive (+) → pain	• Negative (–)
• Talar Tilt Test	• Negative (–)	• Negative (–)
Single Leg Balance		
• Eyes Open	• 12 seconds	• 30 seconds
• Eyes Closed	• 8 seconds	• 25 seconds
Joint Mobility		
• Talocrural PA Glide	• Hypermobile → pain	• Normal
• Talocrural AP glide	• Hypermobile → pain	• Normal

THERAPEUTIC INTERVENTIONS	
INTERVENTION	PROGRESSIONS
Therapeutic Exercise and Neuromuscular Reeducation	
Foot Intrinsics	
• Marbles	• 2 min – progressed by varying object size
• Pen and Quarter	• 1x15 – progressed by increasing WB
Ankle	
• Ankle Pumps	• 2x15 – d/c with increased ROM
• Ankle Figure 8's	• 2x15 – d/c with increased ROM
• Ankle 4-way	• 1x15 – YTB→BlueTB per pt. tolerance
• Gastroc/Soleus Stretch w/ Strap	• 3x30"
• Gastroc/Soleus Slantboard Stretch	• 3x30"
Hip	
• Clamshells	• 1x15 – RTB→BlueTB per pt. tolerance
• Hamstring Stretch w/ Strap	• 3x30"
• Lateral/Monster Walks	• 2 laps – TB @ ankles/knees; R→BlueTB
• Shuttle Press (conc→ecc→plyo)	• 1x15 – 75 →125lbs per tolerance
• Hip 4-way in standing	• 1x15 – RTB→BlueTB per tolerance; +FM
Therapeutic Activity	
Warm-up/Cardio	
• Elliptical	• 8 min
• Treadmill	• 8-10 min; pawing → jogging → running
Balance & Stability	
• Weight Shifts – AP/ML	• Per pt tolerance; d/c when w/o pain
• Balance Board – AP/ML	• 1x30 sec→1 min; +FM per pt tolerance
• Marches/Squats	• 1x15; FM→DD→Bosu (convex→flat)
• Forward Lunges – convex bosu	• 1x15
• Lateral lunges – convex bosu	• 1x15
• SL Ball toss to Rebounder	• 2 min; FM→DD→Bosu→+perturbations
• RDL	• 1x15; FM→weighted→Bodyblade
• Y Balance	• 1x15; Floor→FM
Agility	
• Ladder drills	• 2laps each; Linear→cutting→jumping
• Wall jumps	• 3x30"→1 min; Near EOC
• Zigzag shuffle drill	• 4 laps; +basketball dibble
Manual Therapy	
• Dynamic stabilization - all directions	• Resistance/speed to pt. tolerance
• Ankle isometrics – all directions	• 5-10 sec. x10; resistance to pt. tolerance
• Retrograde massage	• Initially with presentation of swelling
• CFM	• Intensity adjusted per pt. tolerance
• STM	• To gastro/soleus and peroneals as needed
• Joint mobilizations	• AP TC mobs; Grade 1-2→pain, 3-4→increase DF
• PROM	• Into all limited ROM; d/c as AROM increased

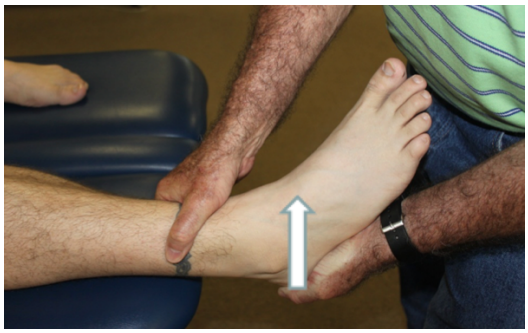
OUTCOME ASSESSMENT						
VISIT	ROM (R)	MMT	PAIN	SPECIAL TESTS	GAIT	OUTCOME MEASURES
EVAL (6/15/21)	DF: 6/25 PF: 60/60 INV: 35/40 EV: 10/25	DF: 3-/5 PF: 3-/5 INV: 3+/5 EV: 3+/5	4/10	(+) Anterior drawer (-) Talar tilt SLS: EO=12;EC=8 TC joint mobs: hypermobile	Mild ataxic gait with notable right in-toeing; bilateral pes planus notable	LEFS: 62/80 CAIT: 14/30
PN (7/13/21)	DF: 15/25 PF: 60/60 INV: 38/40 EV: 13/25	DF: 4/5 PF: 4+/5 INV: 4/5 EV: 4-/5	1/10	(+) Anterior drawer (-) Talar tilt SLS: EO=35;EC=30 TC joint mobs: hypermobile	Notable right in-toeing with dynamic exercises; bilateral pes planus notable	LEFS: 76/80 CAIT: 20/30
DC (7/27/21)	D/C evaluation scheduled; pt contracted COVID and requested to be discharged without re-evaluation					

Appendixes

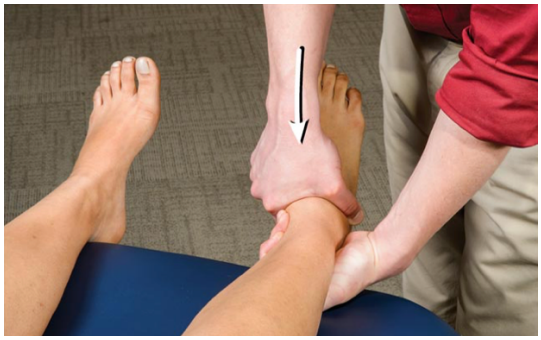
1. Anterior Drawer Test



2. Lateral Talar Tilt Test



3. Anterior-to-Posterior Talocrural Joint Mobilization



4. Anterior-to-Posterior Talocrural Joint Mobilization with Movement